TENT COOPERATION TRE. Y

From the INTERNATIONAL BUREAU

# PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|---|---|
| **Date of mailing** (day/month/year)<br>07 February 2001 (07.02.01) | |
| **International application No.**<br>PCT/AU00/00657 | **Applicant's or agent's file reference**<br>1172/AU |
| **International filing date** (day/month/year)<br>09 June 2000 (09.06.00) | **Priority date** (day/month/year)<br>10 June 1999 (10.06.99) |
| **Applicant**<br>PLATT, Harry, Louis et al | |

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

04 January 2001 (04.01.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| **The International Bureau of WIPO**<br>**34, chemin des Colombettes**<br>**1211 Geneva 20, Switzerland** | Authorized officer<br>A. Karkachi |
| Facsimile No.: (41-22) 740.14.35 | Telephone No.: (41-22) 338.83.38 |

Form PCT/IB/331 (July 1992)

AU0000657

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|---|---|---|
| Applicant's or agent's file reference 1172/au | **FOR FURTHER ACTION** | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416). |
| International application No. **PCT/AU 00/00657** | International filing date *(day/month/year)* 09 June 2000 | Priority Date *(day/month/year)* 10 June 1999 |
| International Patent Classification (IPC) or national classification and IPC **Int. Cl.**[7] A61B 5/0402 | | |
| Applicant 1. PLATT, Harry Louis et al | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of **4** sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheet(s).

3. This report contains indications relating to the following items:

| | | |
|---|---|---|
| I | ☒ | Basis of the report |
| II | ☐ | Priority |
| III | ☐ | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | ☐ | Lack of unity of invention |
| V | ☒ | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | ☒ | Certain documents cited |
| VII | ☐ | Certain defects in the international application |
| VIII | ☐ | Certain observations on the international application |

| | |
|---|---|
| Date of submission of the demand 04 January 2001 | Date of completion of the report 25 January 2001 |
| Name and mailing address of the IPEA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200<br>WODEN ACT 2606 AUSTRALIA<br>E-mail address: pct@ipaustralia.gov.au<br>Facsimile No. (02) 6285 3929 | Authorized Officer<br><br>SUSHIL AGGARWAL<br>Telephone No. (02) 6283 2192 |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU 00/00657

## I. Basis of the report

1. With regard to the **elements** of the international application:*

[X] the international application as originally filed.

[ ] the description, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of .

[ ] the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages , received on with the letter of .

[ ] the drawings, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of .

[ ] the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of .

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

[ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

[ ] the language of publication of the international application (under Rule 48.3(b)).

[ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

[ ] contained in the international application in written form.

[ ] filed together with the international application in computer readable form.

[ ] furnished subsequently to this Authority in written form.

[ ] furnished subsequently to this Authority in computer readable form.

[ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. [ ] The amendments have resulted in the cancellation of:

[ ] the description, pages

[ ] the claims, Nos.

[ ] the drawings, sheets/fig

5. [ ] This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU 00/00657

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | |
|---|---|---|
| Novelty (N) | Claims 1-4 | YES |
| | Claims | NO |
| Inventive step (IS) | Claims 1-4 | YES |
| | Claims | NO |
| Industrial applicability (IA) | Claims 1-4 | YES |
| | Claims | NO |

2. Citations and explanations (Rule 70.7)

The prior art document, WO90/06552 A1, neither discloses nor fairly suggests a method of operating an acquisition and monitoring device, the device having a sleep mode, a wake mode and an operational mode as defined in the claims.

The claims meet the criteria as set out in PCT Articles 33(2)-(4)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU 00/00657

**VI. Certain documents cited**

1. Certain published documents (Rule 70.10)

| Application No. Patent No. | Publication date *(day/month/year)* | Filing date *(day/month/year)* | Priority date ( valid claim) *(day/month/year)* |
|---|---|---|---|
| P, A US 6026335 | 15 February 2000 | 11 July 1997 | 15 July 1996 |

2. Non-written disclosures (Rule 70.9)

| Kind of non-written disclosure | Date of non-written disclosure *(day/month/year)* | Date of written disclosure referring to non-written disclosure *(day/month/year)* |
|---|---|---|

# INTERNATIONAL SEARCH REPORT

International application No. PCT/AU00/00657

**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl. [7]: A61B 5/0402

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
IPC: WHOLE IPC

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC AS ABOVE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| P,A | US 6026335 A (ATLAS) 15 February 2000<br>Whole document | 1-4 |
| A | WO 90/06552 A1 (DALLAS SEMICONDUCTOR CORPORATION) 14 June 1990<br>Whole document | 1-4 |

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
11 August 2000

Date of mailing of the international search report
29 AUG 2000

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaustralia.gov.au
Facsimile No. (02) 6285 3929

Authorized officer

SUSHIL AGGARWAL
Telephone No : (02) 6283 2192

# POWER SAVING LEADS STATUS MONITORING

The present invention relates to the field of battery operated devices such as devices used for monitoring a cardiac patient's electrical cardiac activity and, in particular, to the operation of a power saving or sleep mode of an ECG acquisition system.

## BACKGROUND TO THE INVENTION

In battery operated devices, power consumption is a very important technical characteristic. In order to reduce power consumed by the device, microcontrollers of devices, such as as ECG monitors, use a sleep mode whereby a minimal amount of energy is consumed from the battery.

Often automatic initiation of such a sleep mode and activation of the microcontroller for power and energy saving purposes is based on special requirements and criteria associated with the functionality of the device.

In the case of the ECG acquisition device, one of the important requirements is signal quality monitoring. If leads of the device are disconnected from a patient, no ECG can be acquired and the device can save power by using a sleep mode.

Similarly, the patient's compliance also dictates continuous monitoring of the leads status in sleep mode in order to automatically activate the device upon disconnection or connection of the leads.

Such a task requires at least some of the elements, such as front-end amplifiers, to be operational in sleep mode which means that there is an undesirable power drain from the batteries of known devices.

It would be advantageous to provide a method and apparatus which provides a power supply arrangement which prevents an undesirable power drain.

## OBJECT OF THE INVENTION

It is an object of the present invention to provide a method and apparatus for power saving which substantially overcomes or ameliorates the above mentioned disadvantages.

## DISCLOSURE OF THE INVENTION

According to one aspect of the present invention there is disclosed a method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals, said device having a sleep mode, a wake mode and an operational mode, said method including the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power is supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected.

Preferably, the auxillary oscillator is a low power, low frequency oscillator.

Preferably, the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds.

Preferably, the test execution time is about 0.005 seconds.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be now be described with reference to the accompanying drawing in which:

Fig. 1 is a flow chart of the method of operation an acquisition and monitoring device.

## BEST MODE OF CARRYING OUT THE INVENTION

The method according to the power saving system of the preferred embodiment uses a "sleep-wakeup-check-sleep" sequence for automatic activation of an ECG acquisition and monitoring device. When such a device is used to monitor a patient, it is important for the device to know when the ECG leads are in contact with the patient's skin. If the leads are not in contact, the device is in a sleep mode.

The method includes the use of providing an auxiliary, low power, low frequency oscillator to generate an interrupt signal to "wake up" the microcontroller of the device. The timeout of the interrupt signal is preferably set to occur every few seconds.

On the interrupt condition, ie when the interrupt signal is generated, the microcontroller switches on power for front end amplifiers of the device, waits for a short settling time, tests leads status, (ie whether there is contact or not), and then initiates sleep mode if the leads are not in contact. These routines are preferably performed in a very short time period in comparison to the interrupt timeout period.

Thus the power saving system of the preferred embodiment monitors the status of the leads within periods defined by the interrupt timeout signals. With the interrupt timeout period being much longer than the time period of the leads status test, a sufficient ratio of sleep time to active time is achieved.

In the case where the timeout period is 2 seconds and the test execution time is 0.05 seconds, the ratio is 1:40.

The foregoing describes only one embodiment of the present invention, and modifications obvious to those skilled in the art can be made thereto without departing from the scope of the present invention.

# CLAIMS

1. A method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals, said device having a sleep mode, a wake mode and an operational mode, said method including the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power is supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected.

2. The method of operating an acquisition and monitoring device according to claim 1, wherein the auxiliary oscillator is a low power, low frequency oscillator.

3. The method of operating an acquisition and monitoring device according to claim 1, wherein the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds.

4. The method of operating an acquisition and monitoring device according to claim 1, wherein test execution time is about 0.005 seconds.

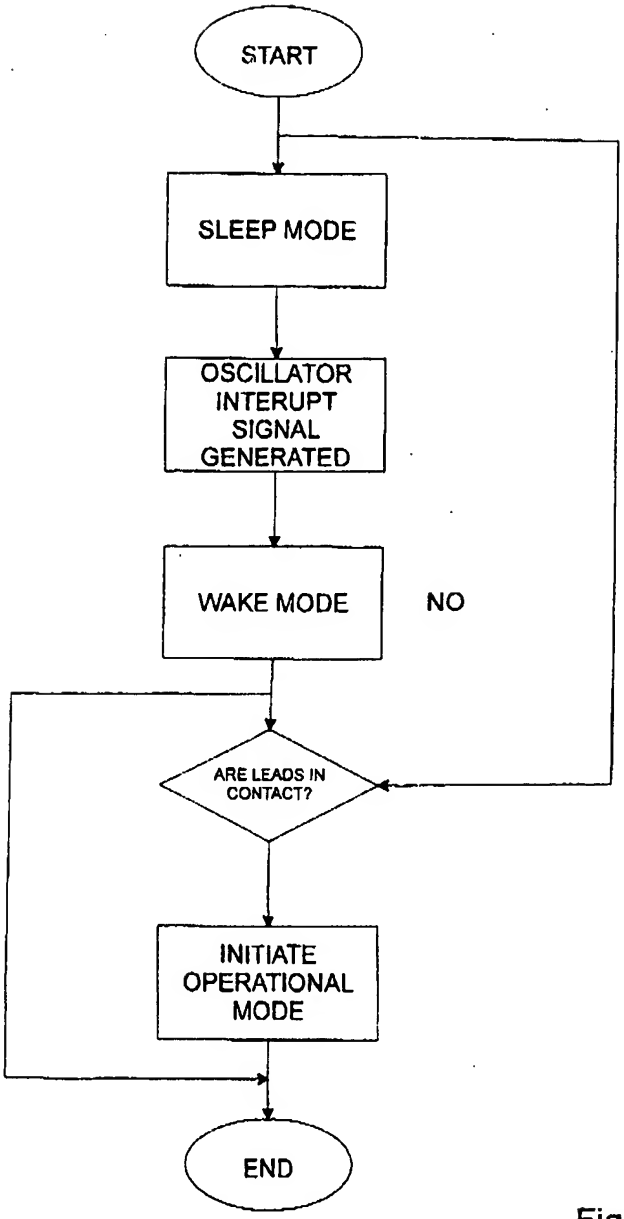

START
SLEEP MODE
OSCILLATOR INTERUPT SIGNAL GENERATED
WAKE MODE
NO
ARE LEADS IN CONTACT?
INITIATE OPERATIONAL MODE
END

Fig. 1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 December 2000 (21.12.2000)

PCT

(10) International Publication Number
WO 00/76396 A1

(51) International Patent Classification[7]: A61B 5/0402

(21) International Application Number: PCT/AU00/00657

(22) International Filing Date: 9 June 2000 (09.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PQ 0886 10 June 1999 (10.06.1999) AU

(71) Applicant *(for all designated States except US)*: SHELL, Allan, Michael [AU/AU]; 14/166 Belmore Road, Randwick, NSW 2031 (AU).

(71) Applicants and
(72) Inventors: PLATT, Harry, Louis [AU/AU]; 14/166 Belmore Road, Randwick, NSW 2031 (AU). JANKOV, Vladimir [AU/AU]; 14/166 Belmore Road, Randwick, NSW 2031 (AU).

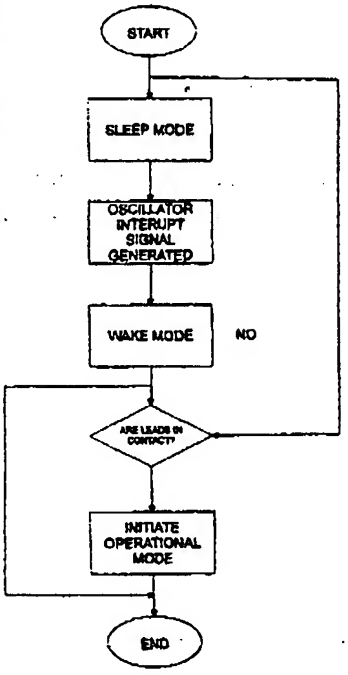
(74) Agent: YOUNG, Philip, Claude; Wilson & Young, P.O. Box 553, Alexandria, NSW 1435 (AU).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

*[Continued on next page]*

(54) Title: POWER SAVING LEADS STATUS MONITORING




(57) Abstract: A method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals is disclosed. The device has a sleep mode, a wake mode and an operational mode, and the method includes the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected. Preferably, the auxiliary oscillator is a low power, low frequency oscillator and the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds, while the test execution time is about 0.005 seconds.

WO 00/76396 A1

14

PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



| Applicant's or agent's file reference 1172/au | **FOR FURTHER ACTION** | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416). |
|---|---|---|
| International application No. **PCT/AU 00/00657** | International filing date *(day/month/year)* 09 June 2000 | Priority Date *(day/month/year)* 10 June 1999 |
| International Patent Classification (IPC) or national classification and IPC **Int. Cl.**[7] A61B 5/0402 | | |
| Applicant 1. PLATT, Harry Louis et al | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of **4** sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheet(s).

3. This report contains indications relating to the following items:

| | | |
|---|---|---|
| I | ☒ | Basis of the report |
| II | ☐ | Priority |
| III | ☐ | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | ☐ | Lack of unity of invention |
| V | ☒ | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | ☒ | Certain documents cited |
| VII | ☐ | Certain defects in the international application |
| VIII | ☐ | Certain observations on the international application |

| Date of submission of the demand 04 January 2001 | Date of completion of the report 25 January 2001 |
|---|---|
| Name and mailing address of the IPEA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200<br>WODEN ACT 2606 AUSTRALIA<br>E-mail address: pct@ipaustralia.gov.au<br>Facsimile No. (02) 6285 3929 | Authorized Officer<br><br>SUSHIL AGGARWAL<br>Telephone No. (02) 6283 2192 |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU 00/00657

## I. Basis f the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed.

☐ the description, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of .

☐ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages , received on with the letter of .

☐ the drawings, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of .

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of .

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig .

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

**V. Reasoned statement under Article 35(2) with regard t novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | |
|---|---|---|
| Novelty (N) | Claims **1-4** | **YES** |
| | Claims | **NO** |
| Inventive step (IS) | Claims **1-4** | **YES** |
| | Claims | **NO** |
| Industrial applicability (IA) | Claims **1-4** | **YES** |
| | Claims | **NO** |

2. Citations and explanations (Rule 70.7)

The prior art document, WO90/06552 A1, neither discloses nor fairly suggests a method of operating an acquisition and monitoring device, the device having a sleep mode, a wake mode and an operational mode as defined in the claims.

The claims meet the criteria as set out in PCT Articles 33(2)-(4)

## VI. Certain documents cited

1. Certain published documents (Rule 70.10)

| Application No. Patent No. | Publication date *(day/month/year)* | Filing date *(day/month/year)* | Priority date ( valid claim) *(day/month/year)* |
|---|---|---|---|
| P, A US 6026335 | 15 February 2000 | 11 July 1997 | 15 July 1996 |

2. Non-written disclosures (Rule 70.9)

| Kind of non-written disclosure | Date of non-written disclosure *(day/month/year)* | Date of written disclosure referring to non-written disclosure *(day/month/year)* |
|---|---|---|

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
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(21) International Application Number: PCT/AU00/00657

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(30) Priority Data:
PQ 0886 10 June 1999 (10.06.1999) AU

(71) Applicant *(for all designated States except US)*: **SHELL, Allan, Michael** [AU/AU]; 14/166 Belmore Road, Randwick, NSW 2031 (AU).

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(72) Inventors: **PLATT, Harry, Louis** [AU/AU]; 14/166 Belmore Road, Randwick, NSW 2031 (AU). **JANKOV, Vladimir** [AU/AU]; 14/166 Belmore Road, Randwick, NSW 2031 (AU).

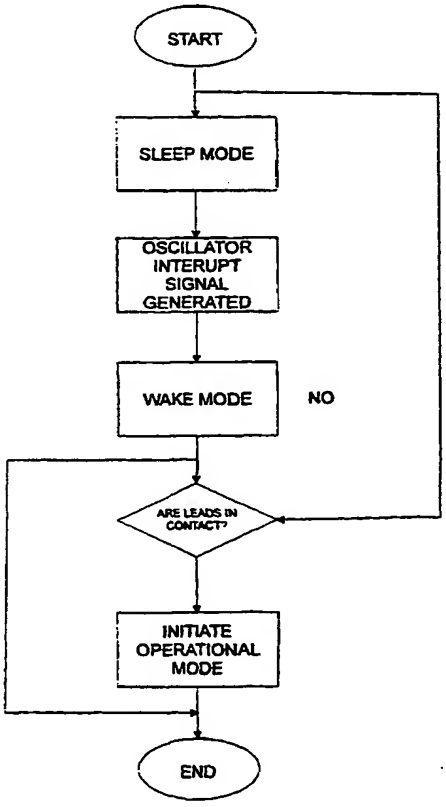
(74) Agent: **YOUNG, Philip, Claude**; Wilson & Young, P.O. Box 553, Alexandria, NSW 1435 (AU).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

*[Continued on next page]*

(54) Title: POWER SAVING LEADS STATUS MONITORING




(57) Abstract: A method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals is disclosed. The device has a sleep mode, a wake mode and an operational mode, and the method includes the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected. Preferably, the auxiliary oscillator is a low power, low frequency oscillator and the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds, while the test execution time is about 0.005 seconds.

WO 00/76396 A1

**Published:**
— *With international search report.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# POWER SAVING LEADS STATUS MONITORING

The present invention relates to the field of battery operated devices such as devices used for monitoring a cardiac patient's electrical cardiac activity and, in particular, to the operation of a power saving or sleep mode of an ECG acquisition system.

## BACKGROUND TO THE INVENTION

In battery operated devices, power consumption is a very important technical characteristic. In order to reduce power consumed by the device, microcontrollers of devices, such as as ECG monitors, use a sleep mode whereby a minimal amount of energy is consumed from the battery.

Often automatic initiation of such a sleep mode and activation of the microcontroller for power and energy saving purposes is based on special requirements and criteria associated with the functionality of the device.

In the case of the ECG acquisition device, one of the important requirements is signal quality monitoring. If leads of the device are disconnected from a patient, no ECG can be acquired and the device can save power by using a sleep mode.

Similarly, the patient's compliance also dictates continuous monitoring of the leads status in sleep mode in order to automatically activate the device upon disconnection or connection of the leads.

Such a task requires at least some of the elements, such as front-end amplifiers, to be operational in sleep mode which means that there is an undesirable power drain from the batteries of known devices.

It would be advantageous to provide a method and apparatus which provides a power supply arrangement which prevents an undesirable power drain.

## OBJECT OF THE INVENTION

It is an object of the present invention to provide a method and apparatus for power saving which substantially overcomes or ameliorates the above mentioned disadvantages.

## DISCLOSURE OF THE INVENTION

According to one aspect of the present invention there is disclosed a method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals, said device having a sleep mode, a wake mode and an operational mode, said method including the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power is supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected.

Preferably, the auxiliary oscillator is a low power, low frequency oscillator.

Preferably, the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds.

Preferably, the test execution time is about 0.005 seconds.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be now be described with reference to the accompanying drawing in which:

Fig. 1 is a flow chart of the method of operation an acquisition and monitoring device.

## BEST MODE OF CARRYING OUT THE INVENTION

The method according to the power saving system of the preferred embodiment uses a "sleep-wakeup-check-sleep" sequence for automatic activation of an ECG acquisition and monitoring device. When such a device is used to monitor a patient, it is important for the device to know when the ECG leads are in contact with the patient's skin. If the leads are not in contact, the device is in a sleep mode.

The method includes the use of providing an auxiliary, low power, low frequency oscillator to generate an interrupt signal to "wake up" the microcontroller of the device. The timeout of the interrupt signal is preferably set to occur every few seconds.

On the interrupt condition, ie when the interrupt signal is generated, the microcontroller switches on power for front end amplifiers of the device, waits for a short settling time, tests leads status, (ie whether there is contact or not), and then initiates sleep mode if the leads are not in contact. These routines are preferably performed in a very short time period in comparison to the interrupt timeout period.

Thus the power saving system of the preferred embodiment monitors the status of the leads within periods defined by the interrupt timeout signals. With the interrupt timeout period being much longer than the time period of the leads status test, a sufficient ratio of sleep time to active time is achieved.

In the case where the timeout period is 2 seconds and the test execution time is 0.05 seconds, the ratio is 1:40.

The foregoing describes only one embodiment of the present invention, and modifications obvious to those skilled in the art can be made thereto without departing from the scope of the present invention.

# CLAIMS

1. A method of operating an acquisition and monitoring device which uses contact means to detect and acquire signals, said device having a sleep mode, a wake mode and an operational mode, said method including the steps of providing an auxiliary oscillator in said device to provide a periodic interrupt signal to wake the device from the sleep mode to the wake mode where power is supplied to the device is minimal, testing connection of contact means to said device after receipt of said periodic interrupt signal, initiating the sleep mode if no connection of contact means is detected or initiating the operational mode if connection of contact means is detected.

2. The method of operating an acquisition and monitoring device according to claim 1, wherein the auxiliary oscillator is a low power, low frequency oscillator.

3. The method of operating an acquisition and monitoring device according to claim 1, wherein the interrupt signal turns on front end amplifiers of said device and has a period of about 2 seconds.

4. The method of operating an acquisition and monitoring device according to claim 1, wherein test execution time is about 0.005 seconds.

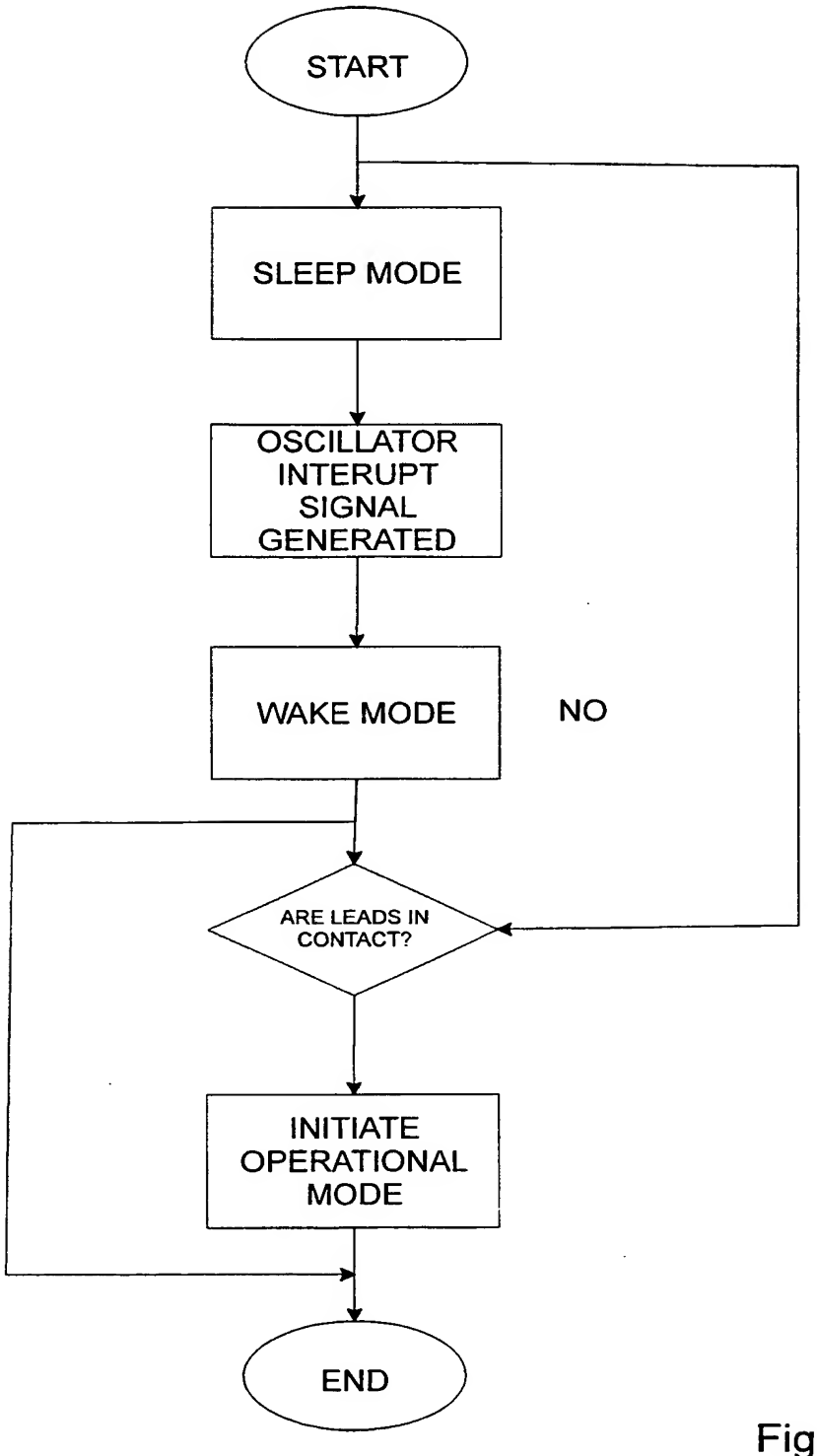

START
SLEEP MODE
OSCILLATOR INTERUPT SIGNAL GENERATED
WAKE MODE
NO
ARE LEADS IN CONTACT?
INITIATE OPERATIONAL MODE
END

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00657

**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl. [7]: A61B 5/0402

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
IPC: WHOLE IPC

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC AS ABOVE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| P,A | US 6026335 A (ATLAS) 15 February 2000<br>Whole document | 1-4 |
| A | WO 90/06552 A1 (DALLAS SEMICONDUCTOR CORPORATION) 14 June 1990<br>Whole document | 1-4 |

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 11 August 2000 | 29 AUG 2000 |
| Name and mailing address of the ISA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200, WODEN ACT 2606, AUSTRALIA<br>E-mail address: pct@ipaustralia.gov.au<br>Facsimile No. (02) 6285 3929 | Authorized officer<br>SUSHIL AGGARWAL<br>Telephone No : (02) 6283 2192 |

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International applicati n No.
**PCT/AU00/00657**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document Cited in Search Report | | Patent Family Member | | | | | |
|---|---|---|---|---|---|---|---|
| US | 6026335 | NONE | | | | | |
| WO | 9006552 | WO | 9006555 | US | 5175845 | US | 5249298 |
| | | US | 5590343 | US | 5754462 | US | 5903767 |
| | | US | 5203000 | | | | |

END OF ANNEX